

REMARKS

Claims 26 and 28-77 are pending in the application with claims 26, 28, 31, 37, 38, and 43 amended herein and claim 27 cancelled herein.

Claims 26, 27, 29-33, 35, 36, and 38-54 stand rejected under 35 U.S.C. 102(e) as being anticipated by Raaijmakers. Applicants request reconsideration.

Amended claim 26 sets forth a capacitor construction that includes, among other features, a first capacitor electrode, a capacitor dielectric layer over the first electrode, a second capacitor electrode over the dielectric layer, and an atomic layer deposited conductive barrier layer to oxygen diffusion between the first and second electrodes. The dielectric layer is over the barrier layer. Pages 3-5 of the Office Action allege that Raaijmakers (hereinafter Ra) discloses the claimed method. However, thorough review of Ra and the particular portions of Ra recited and relied upon by the Office on pages 3-4 of the Office Action reveals that Ra does not disclose atomic layer depositing a conductive barrier layer to oxygen diffusion over a first electrode.

Page 3 of the Office Action states that Ra discloses "a conductive barrier metal containing layer 304" or "conductive barrier layer" over bottom electrode 300 allegedly shown in Fig. 8. Nevertheless, it is clearly apparent from the express teachings of Ra that HSG layer 304 is not intended to function as a barrier layer and does not in fact function as a barrier layer. Figs. 7-10 show that bottom electrode 300 is exposed through HSG layer 304 that supposedly acts as barrier layer. Since bottom electrode 300 is exposed through HSG layer 304, it is impossible for HSG layer 304 to function as a barrier layer.

Further, paragraph [0150] of Ra specifically describes an insulative barrier layer 306 formed from silicon nitride over HSG layer 304 to protect it against oxidation. If HSG layer 304 constitutes a barrier layer as alleged by the Office, then no need would exist to protect HSG layer 304 with insulative barrier layer 306. Notably, barrier layer 306 is insulative rather than conductive, as set forth in claim 26.

In addition, the Office fails to establish that silicon is somehow regarded as a barrier material. Applicant asserts that silicon, of which HSG layer 304 is made, is not considered by those of ordinary skill as a barrier material. Thus, at least for the reasons described herein, Applicant asserts that HSG layer 304 does not disclose a conductive barrier layer to oxygen diffusion, as set forth in claim 26.

Claim 26 further sets forth that the conductive barrier layer to oxygen diffusion is atomic layer deposited between the first and second electrodes. Page 3 of the Office Action alleges that Ra discloses "atomic layer depositing a conductive barrier metal containing layer 304 or forming a conductive barrier layer by chemisorption," and relies upon Figs. 2, 4A, 4B, or the abstract as allegedly describing such atomic layer deposition. However, reference to the recited text as well as the remainder of Ra does not reveal even a mention of forming HSG layer 304 by atomic layer deposition or chemisorption. Paragraph [0010] of Ra describes formation of HSG silicon but does not provide any mention of atomic layer depositing or chemisorbing such a material.

Applicant acknowledges that Figs. 4A and 4B describe forming a self-terminating monolayer, but reference to paragraph [0044] and [0063] of Ra makes it clearly apparent that Ra only contemplates using formation of a self-terminating monolayer in

fabricating capacitor dielectric layers. Ra does not in any way disclose, or even suggest, that atomic layer deposition (ALD) may be used for forming HSG layer 304.

Further, Applicant asserts that no suggestion or motivation exists in the art to form HSG silicon by ALD. The redistribution anneal of amorphous silicon described in paragraph [0010] of Ra to form HSG silicon would clearly redistribute the highly ordered atoms deposited by ALD and it appears would negate any advantage of forming such amorphous silicon by ALD. Accordingly, those of ordinary skill would not use ALD for depositing amorphous silicon to become HSG silicon. At least for the reasons described herein, Applicant asserts that Ra does not disclose the claimed barrier layer being atomic layer deposited.

A finding of anticipation requires disclosure of each and every element of claim 26. However, Ra is deficient in such respect and does not anticipate claim 26. Claims 29, 30, 35, and 50-54 depend from claim 26 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed. For example, claim 29 sets forth a list of compositions for the atomic layer deposited barrier layer. Page 4 of the Office Action alleges that pages 7, 13, and 14 of Ra disclose the claimed compositions. However, page 7 of Ra only pertains to formation of metal oxide dielectrics, which are not conductive since they are dielectrics, and does not describe any of the compositions set forth in claim 29. Also, pages 13-14 of Ra and elsewhere throughout Ra merely describe that a top electrode may include conductive thin film 308 and a remaining portion 310 and provides TiN as an example for thin film 308. Ra does not disclose any of the other compositions listed in claim 5, such as WN, as alleged by the Office. Further, claim 29, by its dependence from claim 26, sets forth

that the capacitor dielectric layer is formed over the conductive barrier layer to oxygen diffusion. In Ra the order is reversed with the TiN formed over dielectric layer 302. Accordingly, Ra does not disclose the subject matter of claim 29.

Applicant notes that claim 26 is amended herein to incorporate all the subject matter of claim 27 that depended there from. Claim 27 was before the Office in preparing the present Action but was erroneously rejected. Accordingly, the entire subject matter of amended claim 26 presented herein was previously presented to the Office and the Office cannot now allege that any subsequent new ground of rejection of claim 26 was necessitated by Applicant's amendment herein. Any new ground of rejection of claim 26 must be presented in a non-final rejection. The Office may contact the undersigned with any disagreement regarding this matter that may arise prior to mailing the next action.

Amended claim 31 sets forth a capacitor construction that includes, among other features, a first capacitor electrode, a conductive barrier layer to oxygen diffusion over the first electrode, a capacitor dielectric layer over the barrier layer, and a second capacitor electrode over the dielectric layer. The barrier layer includes a chemisorption product of first and second precursor layers. Pages 3-4 of the Office Action allege that Ra discloses the subject matter of claim 31. However, as may be appreciated from the above discussion regarding the deficiencies of Ra as applied to claim 26, Ra fails to disclose a conductive barrier layer over the first capacitor electrode and a capacitor dielectric layer over the barrier layer. Claims 32, 33, and 36 depend from claim 31 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed.

Amended claim 38 sets forth a capacitor construction that includes, among other features, a first capacitor electrode, a capacitor dielectric layer over the first electrode, a second capacitor electrode over the dielectric layer, and an atomic layer deposited metal-containing conductive layer between the first electrode and dielectric layer. Page 3 of the Office Action alleges that HSG layer 304 discloses the claimed metal-containing conductive layer. However, as may be appreciated from the above discussion regarding the deficiencies of Ra as applied to claim 26, HSG layer 304 is not a metal-containing conductive layer. Also, Ra does not disclose atomic layer depositing HSG layer 304. Further, Ra does not disclose a capacitor dielectric layer over an atomic layer deposited conductive layer. At least for such reasons, Ra does not disclose the subject matter of claim 38. Claims 39-42 depend from claim 38 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed. For example, claims 40 and 41 set forth compositions for the atomic layer deposited conductive layer. As may be appreciated from the discussion above regarding the deficiencies of Ra as applied to claim 29, Ra does not disclose the subject matter of claims 40 or 41.

Amended claim 43 sets forth a capacitor construction that includes, among other features, a first capacitor electrode, a layer of a metal-containing conductive material over the first electrode, a capacitor dielectric layer over the conductive layer, and a second capacitor electrode over the dielectric layer. The conductive material includes a chemisorption product of first and second precursor layers. As may be appreciated from the discussion herein regarding the deficiencies of Ra as applied to claim 26, Ra does not disclose a chemisorption product of first and second precursor layers being

comprised by a layer of a metal-containing conductive material with a capacitor dielectric layer over the conductive layer. Applicant asserts that claim 43 is thus not anticipated by Ra. Claims 44-49 depend from claim 43 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed.

At least for the reasons established herein, claims 26, 27, 29-33, 35, 36, and 38-54 are not anticipated by Ra and Applicant requests allowance of such claims in the next Office Action.

Claims 28, 34, 37, and 55-77 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers. Applicants request reconsideration.

Claim 37 sets forth a capacitor construction that includes, among other features, a first capacitor electrode, a conductive barrier layer to oxygen diffusion over the first electrode, a capacitor dielectric layer over the barrier layer, and a second capacitor electrode over the dielectric layer. The barrier layer includes Pd or Pd alloys as a chemisorption product of first and second precursor layers. Page 6-7 of the Office Action allege that Ra teaches the claimed barrier layer. However, as may be appreciated from the discussion herein regarding the deficiencies of Ra as applied to claim 26, Ra does not disclose or suggest a conductive barrier layer to oxygen diffusion over a first electrode and a dielectric layer over the barrier layer.

The Office Action acknowledges on pages 6-7 that Ra does not disclose the barrier layer including Pd or Pd alloys. However, the Office alleges that it would be "obvious in the art to use Pd or Pd alloys since the chemical properties of Pd or Pd alloys are similar to those compounds disclosed in Ra." Notably, HSG layer 304 in Ra constitutes the structure that the Office alleges discloses the claimed conductive barrier

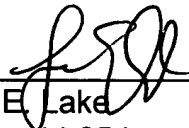
layer to oxygen diffusion. HSG layer 304 contains Si which is widely recognized as exhibiting very different chemical properties compared to Pd and its alloys. Applicants assert that those of ordinary skill would not contemplate substituting Pd for the hemispherical grain silicon of HSG layer 304. Not only are the chemical properties different, but the structural advantages of HSG in increasing surface area apparently would be lost by substitution with Pd or its alloys. The Office Action does not identify any of the supposedly similar chemical properties. Accordingly, the Office Action is fatally defective in not properly supporting the allegation of a motivation to modify the teachings of Ra. At least for such reasons, claim 37 is patentable over Ra.

Claims 28, 34, and 55-77 depend from claims 26, 31, 38, or 43. Applicant establishes herein that the subject matter of independent claims 26, 31, 38, and 43 are not disclosed by Ra. Applicant further asserts that Ra does not suggest the subject matter of the independent claims that is otherwise not disclosed by Ra. The mere fact that the prior art can be modified does not make the modification obvious "unless the prior art suggested the desirability of the modification." In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984); MPEP 2143.01. Applicant asserts that Ra does not suggest the desirability of any modifications to the disclosure of Ra such that the claimed subject matter results. Accordingly, claims 28, 34, 37, and 55-77 are patentable over Ra and Applicant requests allowance of such claims in the next Office Action.

In keeping with the assertions herein, Applicant asserts that claims 26 and 28-77 are in condition for allowance and Applicant requests such allowance in the next Office Action.

Respectfully submitted,

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